

REMARKS

Claims 7-13 are pending in the present application. Claims 1-6 have been canceled. Claim 7 has been amended. Claim 13 has been added. No new matter has been entered. The amendment to claim 7 is supported by the specification on page 10, line 21 to page 11, line 9 and Figs. 1-2. New claim 13 is supported by the specification on page 13, line 25 to page 14, line 4.

Claim 1 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Yoshiki et al, U.S. Patent No. 5,843,236 in view of Ohmi et al. (EP 1 032 097 A2) and Shinji et al., JP 62-152127. Claims 2-6 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Yoshiki et al, U.S. Patent No. 5,843,236 in view of Ohmi et al. (EP 1 032 097 A2) and Shinji et al., JP 62-152127 as applied to claim 1 and further in view of Hiroshi et al., U.S. Patent No. 5,389,154. These rejections have been obviated by the cancellation of claims 1-6.

Claim 7 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Yoshiki et al, U.S. Patent No. 5,843,236 in view of Ohmi et al. (EP 1 032 097 A2), Shinji et al., JP 62-152127, and Kou et al., U.S. Patent No. 6,246,175. This rejection is respectfully traversed.

Yoshiki et al., Shinji et al., Kou et al., and Ohmi et al. do not disclose or teach that “in the side of the straight shape_microwave cavity resonator, first resonance units having a length $\lambda_g/2$ (λ_g : guide wavelength) but not having an opening in the side and second resonance units having a length $\lambda_g/2$ and having at least one second opening in the side are alternately arranged sequentially from the terminal end portion,” referred to as configuration A.

Specifically, Yoshiki et al. only discloses that slot arrays are arranged at intervals of a length $\lambda g/2$. Yoshiki et al. does not disclose configuration A of amended claim 7.

Further, Ohmi et al. only discloses that when a pitch between slots is set λg , in-phase microwaves are emitted from a plurality of different slots. Ohmi et al. does not disclose configuration A of amended claim 7.

In contrast, in the present invention of amended claim 7, a phase of standing waves formed in the open areas is mutually arranged by using configuration A, so that in-phase microwaves can be led to the plasma generating chamber. Further, by using the resonance unit of the present invention, the following specific advantages are obtained.

The First Advantage Obtained by Using the Resonance Unit of the Present Invention

The use of a resonance unit in the invention recited in claim 7 can stabilize standing waves. The resonance unit generally has a wavelength selectivity and the invention recited in claim 7 actively utilizes the properties thereof.

The above-mentioned stabilized standing waves of the invention recited in claim 7 enable the in-phase microwave of single mode to be extracted from the second opening slot.

In contrast, the absence of the resonance unit of the present invention is likely to generate a plurality of microwave modes in a waveguide, therefore allowing microwaves of different phases to coexist in the microwave extracted from the slot.

The Second Advantage Obtained by Using the Resonance Unit of the Present Invention

The use of the resonance unit in the invention recited in claim 7 stabilizes the impedance to a load variation viewed from the microwave generator side. This load variation is due to the time variation of the plasma generated in the plasma generating chamber.

In contrast, the absence of the resonance unit of the present invention allows the impedance viewed from the microwave generator side to be affected directly by the load variation, which disrupts the impedance matching by the impedance matching device generally provided between the microwave generator and the loadings. Specifically, the impedance matching performed to track the load variation results in the matching not being converged in terms of time, such that the generation of the plasma becomes intermittent and flickers. High quality films are difficult to form in these plasmas.

The invention recited in claim 7 minimizes the variations of the impedance viewed from the microwave generator side due to the load variation and facilitates the impedance matching by providing the resonance unit in the microwave introducing means. As a result, the load variation can be followed by the impedance matching, and a stable plasma with less time variation can be generated.

The impedance matching is equivalent to the adjustment of the standing wave position, and therefore it can be understood that the stabilization of the standing wave position in the resonance unit makes impedance matching easier by suppressing the impedance variation.

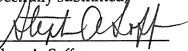
As mentioned above, the use of the resonance unit and its specific advantages are not disclosed or suggested in any of the cited references and are only attained by the invention recited in claim 7.

Claims 8-12 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Yoshiki et al, U.S. Patent No. 5,843,236 in view of Ohmi et al. (EP 1 032 097 A2), Shinji et al., JP 62-152127, and Kou et al., U.S. Patent No. 6,246,175, as applied to claim 7, and further in view of Hiroshi et al., U.S. Patent No. 5,389,154. These claims, as well as new dependent claim 13, are submitted to be allowable for the reasons set forth above with respect to the independent claim 7, from which they depend.

In view of the above amendment, applicant believes the pending application is in condition for allowance.

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Respectfully submitted,

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